



**PATENT APPLICATION**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Jun FUJITA

Group Art Unit: 1734

Application No.: 10/511,139

Examiner: M. MAYES

Filed: October 14, 2004

Docket No.: 121510

For: METHOD OF MANUFACTURING HONEYCOMB STRUCTURAL BODY

**DECLARATION UNDER 37 C.F.R. §1.132**

I, Naoto Kouketsu, a citizen of Japan, hereby declare and state:

1. I have degrees in Mechanical and Aerospace Engineering and Microsystem Engineering which were conferred upon me by Nagoya University in Nagoya, Japan in 2000 and 2002.

2. I have been employed by NGK Insulators, Ltd. since 2002 and I have had a total of five years of work and research experience in process development and process engineering.

3. My publications include the following works in this field: "Pinpoint Injection of Micro Tools Using Dielectrophoresis and Hydrophobic Surface for Minimally Invasive Separation of Microbe." F. Arai et al., Proc. Of the Fifteenth IEEE Int'l conf. On Micro Electro Mechanical Systems (MEMS 2002), pp. 48-51 (2002).

4. I have a professional relationship with NGK Insulators, Ltd. of the above-identified patent application. In the course of that professional relationship, I received compensation directly from Assignee NGK Insulators, Ltd. for my work relating to process engineering. I am being compensated for my work in connection with this Declaration.

5. I and/or those under my direct supervision and control have conducted the following tests:

Date of Experiment: May 28, 2007

Summary:

A test was carried out to confirm the difference between the present application of our company and U.S. Patent No. 4,557,773 to Bonzo. The test focused on the fact that the method of making holes in a film described in the Bonzo reference is not a method using a laser as described in the present application but a method using a needle. It was confirmed that, in the case of making holes with a needle, a plugged portion is prone to be damaged upon peeling off of the film after plugging, and that, in the case of not using a laser, which is an element of the present application, for making holes, there is caused a difference in quality after plugging from the segment of the present application.

Object:

Assess the quality of the external appearance after plugging using a needle (Bonzo) as compared with using a laser (present application).

Method of the Experiment:

1. Two kinds of samples were prepared: sample (1) has holes made with a diameter of about 1.0 mm using a laser in a film having a total thickness of 25  $\mu\text{m}$ ; and sample (2) has holes made with a diameter of about 1.0 mm using a needle.
2. The shape of the holes were observed.
3. After a plugging material was put in the holes, the film was put in a drying machine at 120°C for one hour to be dried sufficiently.
4. An end face of a honeycomb structure was observed after the film was peeled off. In particular, the portion to be plugged was examined carefully by checking the state of the holes after peeling off the film.

Result:

Analysis of the newly created holes of the film:

In sample (1), the holes at the planned portion were formed by boring the corresponding portions of the film by laser beam. The holes were formed by removing the film. Thus, the quality of the holes was good.

In sample (2), the holes at the planned portion were formed by a press-bending process with a needle. Since the holes were formed by allowing the film to be cut and bent inward of the cell of the honeycomb structure, the quality of the holes was inferior to that of sample (1) as shown in pics. 1 and 2 below.



Pic. 1: Sample (1)



Pic. 2: Sample (2)

Analysis of the plugged portions after peeling off the film:

Sample (1) including the plugged portions had no loss in the honeycomb structure.

Sample (2) had a sign of a subsidence with a certain depth in a plugged portion.

Neither samples (1) nor (2) had damage to the cell walls of the honeycomb structure of this experiment.

Conclusion:

Items of the investigation at this time and the results are shown in bold with respect to the present application.

Table 1

	Example 1	Example 2	Example 3	Comp. Ex. 1
Total film thickness(μm)	20	25	30	50
Quality of making a hole	Good	Good	Fairly good	Not good
Easiness in plugging the planned portion with plugging material	Very easy	Very easy	Very easy	Not easy
Easiness in peeling of film (just after drying)	Very easy	Very easy	Very easy	Not easy
Boring (laser)	Very easy	Very easy	Very easy	Easy
Easiness in peeling of film (after leaving)	Very easy	Very easy	Easy	Not easy
Occurrence of breakage of formed body after peeling off of film	Not Occurred	Not Occurred	Not Occurred	Occurred
Occurrence of breakage in honeycomb structures when film was removed by firing	Not Occurred	Not Occurred	Not Occurred	-
Occurrence of breakage in plugged portion after peeling off a film	Not Occurred	Not Occurred	Not Occurred	-

Quality of making a hole	-	Good	-	-
Easiness in plugging the planned portion with plugging material	-	Very easy	-	-
Occurrence of breakage in plugged portion after peeling off a film	Occurred	-	-	-

Discussion:

A loss in a plugged portion was confirmed because, as shown in Pic. 2, a bent portion of the film is embedded in a plugging material upon plugging and the film pulls out the plugging material upon peeling off the film (Fig. 1). Thus, it is difficult to obtain equivalent quality of a honeycomb structure of the present application using a needle. Because of the mechanism of the loss using a needle, regardless of material, thickness, bonding force, or the like, the removal process using a laser or the like of the present application should be employed.

As problems caused by damage in plugged portions, the following points can be made. Depending on strength of a honeycomb structure, the risk of damaging the cell wall in contact with the plugging material which is pulled out with the bent portion of the film when pulling out the plugging material increases. In particular, the higher the porosity of the porous honeycomb structure is, generally, the lower the strength is. Therefore, a honeycomb structure employing a material having high porosity has a higher risk of being damaged than materials of lower porosity. In addition, a loss of the plugged portion increases the risk of forming a penetrating passage extending between a pair of end faces and leading to the spoiling of the filter function, which is a mission of DPF products.



Application No. 10/511,139

Loss of Plugged Portion by Making Hole with Needle

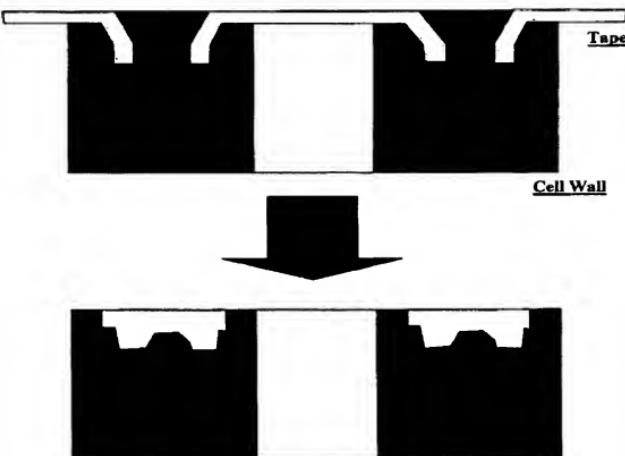


Fig. 1

I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine and/or imprisonment under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing therefrom.

Date: Aug 13, 2007

Naoto Kouketsu

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